Department of Development Services
Building Division

4701 W. Russell Rd • Las Vegas NV 89118
(702) 455-3000 • Fax (702) 221-0630

Phil Rosenquist, Director • Ronald L. Lynn, Building Official

SUBJECT: **TG-60-IBC-2000 edition: SMOKE-CONTROL and Related Topics**

1.0 PURPOSE: This guideline establishes responsibilities for submittals, document review, and installation verification, testing and reporting.

2.0 SCOPE: This guideline is applicable to the 2000 International Building Code as amended. This document is intended to provide detail necessary for those submitting plans and reporting documents on what is expected to comply with various code provisions.

3.0 ABBREVIATIONS & ACRONYMS:

AABC	Associated Air Balance Council
CCBAC	Clark County Building Administrative Code
CCDDS-BD	Clark County Department of Development Services – Building Division
CCFD:	Clark County Fire Department
FPR:	Fire Protection Report
NEBB	National Environmental Balancing Bureau
IBC:	International Building Code
QAA:	Quality Assurance Agency
SNBCA:	Southern Nevada Building Code Amendments
TG:	Technical Guideline

APPROVED DATE: September 15, 2004
EFFECTIVE DATE: October 1, 2004

Written by:	Concurred by:	Approved by:
/s/	/s/	/s/
Theodore L. Droessler, P.E. Principal Engineer	Jim Arnold Associate Engineer	Anne Marie Long, P.E. Senior Engineer

4.0 DEFINITIONS:

For the purposes of this technical guideline certain terms, phrases, words and their derivatives shall be construed as specified in this section, the International Building Code and the Building Administrative Code of Clark County.

Activation Zone is the smoke-control zone that initiated a smoke-control mode.

Active Subzone: is a mechanical smoke-control zone within a smoke-control zone.

Dedicated Systems: Dedicated smoke-control systems are installed for the sole purpose of providing smoke-control. They are separate systems of air-moving and distribution equipment that do not function under normal building operating conditions. Upon activation, these systems operate specifically to perform the smoke-control function.

Nondedicated Systems: Nondedicated systems are those that share components with some other system(s) such as the building HVAC system. Activation causes the system to change its mode of operation in order to achieve the smoke-control objectives.

Fire Command Center: A room with emergency equipment capable of supporting fire department operations and containing the firefighter's smoke control panel and the fire alarm control panel.

Fire Protection Report – A document that describes fire protection features.

Phased Construction Fire Protection Report - A document described in the Fire Protection Report Design Guide published by CCDDS-BD.

Peer Review – An independent and objective technical review of the design of a building or structure to examine the proposed conceptual and analytical concepts, objectives and criteria of the design and construction. It shall be conducted by an architect or engineer who has at least a comparable level of experience in the design of projects similar to the one being reviewed as those of the architect or engineer responsible for the project.

****PRINCIPAL DESIGN PROFESSIONAL** is an architect registered pursuant to NRS Chapter 623 or a professional engineer licensed pursuant to NRS Chapter 625, who is responsible for the coordination of each aspect of the construction documents that are submitted to the Building Official for permit.

Passive Subzone is a passive smoke-control zone within a mechanical smoke-control zone in which smoke containment is achieved by a smoke barrier.

****Prime Agency** is an approved agency that maintains employment of a qualified engineering manager.

Slightly Positive/Negative is a pressure difference identified in the fire protection report or the test plan to establish a boundary condition.

@***Smoke Barrier** is a continuous membrane, either vertical or horizontal, such as a wall, floor or ceiling assembly that is designed and constructed to restrict the movement of smoke.

Smoke-Control Diagrams – Construction documents that depict device locations, equipment performance, systems integration and sequencing of smoke-control measures necessary to verify compliance to the design

approach outlined in the fire protection report. These diagrams shall include a smoke-control matrix, smoke-control zone layouts, and activation zone layouts.

Smoke-Control Matrix – A document that identifies the configuration of smoke-control devices based upon activation of initiating devices.

***Smoke-Control Mode** is a predefined operational configuration of a system or device for the purpose of smoke-control.

***Smoke-Control System, Mechanical** is an engineered system that uses mechanical fans to produce pressure differences across smoke barriers or establish airflows to limit and direct smoke movement.

***Smoke-Control System, Passive** is a system of smoke barriers arranged to limit the migration of smoke.

***Smoke-Control Zone** is a space within a building enclosed by smoke barriers.

Subzone is a smoke-control zone that shares activation with the surrounding smoke-control zone.

***Zoned Smoke-Control** is a smoke-control system utilizing pressure differences between adjacent smoke-control zones.

@ Defined in the International Building Code 2000 edition
* Defined in the Uniform Building Code 1997 edition
**Defined in the Building Administrative Code of Clark County 2004 edition
Defined in the ICC Performance Code for Buildings and Facilities 2001 edition
Defined in NFPA 92A, 2000 Edition

5.0 REFERENCES:

Clark County Building Administrative Code – latest edition
Fire Protection Report Design Guide – September 2003
Procedure for Applications Involving Alternate Materials and Methods of Construction – May 2001
Southern Nevada Building Code Amendments – February 11, 2003
TG-15 Quality Systems Manual
TG-16 Quality Assurance Agency Obligations
TG-17 Minimum Approval Criteria for Special Inspectors and Other Personnel
TG-50 Reporting Requirements
International Building Code 2000
Variable Frequency Drives used in Smoke-Control Systems dated June 24, 2002 published by Clark County Department of Development Services – Building Division

6.0 RESPONSIBILITIES:

6.1 Project Owner

6.1.1 Principal Design Professional designation

6.1.2 Authorize peer review

6.1.3 Contract smoke-control verification and development of the test plan with the Prime Agency

6.1.4 Coordination of smoke-control diagram updates

6.1.5 Maintenance of smoke-control diagram as-built

6.1.6 Coordinate document submittals

6.1.6.1 Fire protection report

6.1.6.2 Alternate materials and methods requests

6.1.6.3 Smoke-control diagrams

6.1.6.4 Test Plan

6.1.6.5 Smoke-control final report

6.2 Designers

6.2.1 Architect

6.2.2 Principal Design Professional

6.2.3 Author of fire protection report (Architect, Fire Protection Engineer, Mechanical Engineer)

6.2.3.1 Describe the fire protection approach for the entire project

6.2.3.2 Establish the smoke-control design approach

6.2.3.3 Outline smoke-control pass/fail criteria

6.2.3.4 Smoke-Control Test Plan Checklists shall be submitted as part of the fire protection report – Attachment – C (IBC 909.3)

6.2.3.5 Remodels and additions – existing system operation

6.2.4 Electrical Engineer

6.2.4.1 Load considerations

6.2.4.2 Emergency power response

6.2.5 Fire Protection Engineer

6.2.5.1 Alternate materials and methods submittal

6.2.5.2 Fire protection report submittal

6.2.6 Mechanical Engineer

6.2.6.1 HVAC system design

6.2.6.2 Smoke-control system design

6.3 Permit Holder

6.3.1 Inspection access

6.3.2 Marking and identification

6.3.3 Pretest of equipment and systems prior to Prime Agency verification

6.3.4 Submit test plan at smoke-control meeting. See 6.1.3 above (IBC 909.3)

6.4 Building Division

6.4.1	Mandate building upgrades - Chapter 34 ---	Plan Examination
	6.4.1.1 Incremental additions	
6.4.2	Remodel and change of occupancy ---	Plan Examination
6.4.3	Alternate materials and methods review ---	Plan Examination
6.4.4	Mandate peer review	Plan Examination
6.4.5	Fire protection report review	Plan Examination
6.4.6	Smoke-control diagram review	Inspection Office
	6.4.6.1 Smoke-control diagram checklist	– Attachment B
6.4.7	Smoke -control test plan review	Inspection Office
6.4.8	Smoke-control final report review	Inspection Office
	6.4.8.1 Final report checklist	– Attachment E
6.4.9	Life-safety systems test	Inspection Office

6.5 Fire Department
- 6.5.1 Sprinkler drawing review
- 6.5.2 Fire alarm drawing review
- 6.5.3 Smoke-control panel layout review
- 6.5.4 Fire protection report review (concurrent with CCDDS-BD)
- 6.5.5 Functional testing and sign off of fire alarm and sprinkler systems
- 6.5.6 Inspection and testing of existing smoke-control systems

6.6 Prime Agency
- 6.6.1 Submit project start-up form
- 6.6.2 Develop Test Plan
- 6.6.3 Perform and coordinate testing and inspection required for the project
- 6.6.4 Assign CCDDS-BD approved personnel to the project
- 6.6.5 Coordinate inspection and testing with air balance company
- 6.6.6 Execute smoke-control test plan (IBC 909.3)
- 6.6.7 Prepare and submit the final report

6.7 Special Inspector

6.7.1 Perform inspection and testing as required by the approved construction documents.

7.0 PROCEDURE:

7.1 Project Owner

7.1.1 A special inspection agreement is required to be executed by the owner or the owner's agent. The special inspection agreement is issued with the mechanical permit for mechanical smoke-control and may be issued with a building permit for passive systems.

7.1.2 The owner shall coordinate the submittal of the smoke-control final report to allow report preparation, review by the jurisdiction and life safety systems testing.

7.1.3 Certain documents are required to be maintained in the fire command center upon

completion of testing and shall include.

7.1.3.1 Fire protection reports
7.1.3.2 Smoke-control diagrams
7.1.3.3 Smoke-control final report
7.1.3.4 Approved copies of requests for alternate materials and methods of construction

7.2 Designers

7.2.1 Smoke-control and related documents shall be prepared in accordance with the references listed in Section 5.

7.2.2 Requests for alternate materials and methods shall be submitted to and reviewed by the Plan Examination office and include the criteria to verify compliance during construction. Updates to smoke-control diagrams are required when changes are made to device locations, zone layouts or the systems integration and sequencing.

7.2.3 Fire protection reports shall be submitted to and reviewed by the Plan Examination office. The fire protection report shall be approved prior to the approval of the smoke-control diagrams.

7.2.4 Smoke-control diagrams shall be submitted to CCDDS-BD inspection office. Smoke-control diagram approval is required prior to a rough mechanical inspection. A minimum of three copies of the smoke-control diagrams shall be submitted for approval.

7.2.5 Designers of record shall sign off on the special inspection final report as required by Section 909.18.8 of the International Building Code. (See SNBCA 909.18.8.3)

7.2.6 Designers of record providing special inspection verification require CCDDS-BD approval as a quality assurance agency in accordance with Technical Guidelines 15, 16 and 17.

7.3 Building Division

7.3.1 The Plan Examination office reviews fire protection reports. The fire protection report shall be approved prior to the approval of the smoke-control diagrams.

7.3.2 The inspection office reviews smoke-control diagrams. Smoke-control diagrams are reviewed for conformance to the fire protection report, International Building Code, SNBCA and any approved alternate materials and methods submittals. Smoke-control diagrams shall include specific functions and sequences to verify code requirements and any additional criteria outlined in the fire protection report and approved alternates. Smoke-control diagram review will compare the smoke-control test plan checklist (attachment C) for the specific project activation zones with the smoke-control diagrams submitted. A detailed review to the smoke-control diagram checklist (attachment B) will be performed to confirm the drawings are reasonable for approval.

7.3.3 The inspection office reviews smoke-control test plans with emphasis on boundary conditions between active zones, passive zones, subzones and existing construction. The test plan must take into account the potential effect of adjacent mechanical systems under operating conditions.

7.3.4 The inspection office reviews smoke-control final reports. Final reports are reviewed for compliance to the inspection and testing required by the fire protection report, smoke-control diagrams, approved smoke-control test plan, approved alternates, SNBCA and International Building Code. A final report checklist is included as attachment E.

7.4 Fire Department

7.4.1 Fire Department smoke-control responsibilities are listed in Section 6. Additional review and inspection items may be required that are beyond the scope of this document and need to be coordinated with the Fire Department.

7.5 Permit Holder

7.5.1 The general contractor shall schedule a smoke-control meeting prior to the approval of smoke-control diagrams. A smoke-control test plan shall be presented at this meeting. A minimum of three copies of the test plan are required for submittal and approval.

7.5.2 Smoke-control diagram approval is documented as a clearance as part of the required inspection process. Smoke-control diagrams shall be approved prior to rough mechanical inspection.

7.5.3 Inspection, testing and additional verification activities shall be coordinated with the special inspection agency. Access to the equipment and related documentation shall be provided to the special inspection agency.

7.5.4 Device location and marking shall be as required by the code and shall comply with listing requirements.

7.5.5 Contractors shall pretest equipment and systems prior to verification by the special inspector.

7.6 Quality Assurance Agency

7.6.1 Agencies and their personnel shall be listed and approved in accordance with Technical Guidelines 15, 16 and 17.

7.6.2 Inspection, testing and system verification shall be as required by the approved documents. When conflicts are found between the approved documents, the fire protection report shall be the first source of resolution. If the fire protection report does not provide enough detail, then the code, TG-60 and approved alternates shall be referenced in this order.

7.6.3 Reporting shall be in accordance with Technical Guideline 50.

7.6.3.1 A final report checklist is enclosed as attachment E.

7.6.3.2 Final report cover letters shall be sealed and signed by a licensed professional. This person is responsible for the assembly and review of the final report.

7.6.3.2.1 The smoke-control registered design professional of record shall seal and sign a statement as required by IBC Section 909.18.8.3. (See SNBCA 909.18.8.3)

7.6.3.2.2 Air balance firms shall submit a cover letter that describes their verification activities to the person responsible for assembly of the final report.

7.7 Inspection & Testing:

7.7.1 **Smoke Barrier Construction**: (IBC 909.5) [405.4.2, 407.3, 407.4, 408.6, 709, 711.3] Smoke barriers shall be constructed of an assembly complying with IBC Section 709 and having a minimum fire-resistance rating of one hour. Construction of the smoke barrier assembly and seal will be visually inspected by CCDDS-BD.

In addition to visual inspection, smoke barrier construction containing mechanical smoke-control zones shall be functionally tested. Smoke barrier construction may be accepted when, with the system in a smoke-control mode, tracer gas demonstrates that smoke does not migrate to other smoke-control zones. Smoke barrier performance must be demonstrated for all possible mechanical system configurations, including the various configurations of mechanical systems used for environmental comfort and exhaust and under both regular and emergency power.

Passive zone smoke barrier construction shall be leakage tested, in accordance with recognized standards, to demonstrate compliance with established acceptance criteria. Smoke barrier acceptance criteria shall be as established by the registered design professional of record using the allowable leakage calculations of Section 909.5. Verification methodology shall be fully detailed in the approved smoke-control test plan when a recognized testing standard is not referenced. The frequency and location of smoke barrier leakage testing shall also be documented in the approved smoke-control test plan.

Mechanical smoke-control systems using the pressurization method shall be tested with the system in a smoke-control mode. The design pressure differential shall be verified across the zone boundary smoke barrier at all openings that can be tested with conventional equipment.

Smoke barriers containing mechanical smoke-control zones using the airflow method or the exhaust method may be verified by the QAA through a combination of functional testing using tracer gas and visual inspection.

7.7.2 **Opening Protection:** (IBC) [709, 711, 712, 714, 715, 909.5.2, 1004.3.4.3.2] SNBCA 909.5.2

The fire protection rating of doors in smoke barriers depends upon the fire-resistance rating of the smoke barrier in which it is placed (per Table 714.2) but shall be a minimum of 20 minutes. The fire protection rating of dampers in smoke barriers depends upon the fire-resistance rating of the smoke barrier in which it is placed (per Table 715.3.1) but shall be a minimum of 1.5 hours. Refer to NFPA 80 for the maximum clearances permitted around doors. Opening protection in mechanical smoke barriers requires activated automatic closing devices that shall be verified by the QAA. Verification shall include location pursuant to the smoke-control diagrams, and installation in accordance with the listing. QAA testing shall verify control per the smoke control diagram matrix and any monitoring that is required by the approved documents.

Typical examples of opening protection that may require automatic closing devices:
Doors Dampers Fire Shutters Proscenium Curtain
Conditions that may require a releasing device include: smoke compartments required for I-occupancy, membrane or through penetrations at a smoke barrier.

Smoke barrier opening protection utilizing the airflow method must be demonstrated for smoke-control system configurations under both regular and emergency power.

7.7.3 **Equipment General: (**IBC 909.10)
Equipment shall be verified to meet the temperature ratings specified on the smoke control diagrams and the rational analysis. Substantiating assumptions such as mass flow rates shall be part of the specifications and equipment shall be verified to meet the limitation during system testing. Verification of both airflow and exhaust method flow rates shall be as required by the design and documented when the mechanical smoke-control system is placed in a smoke-control mode.

7.7.4 **Exhaust Fans: (**IBC 909.10.1) See code sections 905.7.6 and 905.15.6.

7.7.5 **Ducts: (**IBC 909.10.2)
Duct leakage testing is required for all smoke-control ductwork that crosses a smoke barrier. Verification of allowable leakage rates shall be in accordance with stamped design calculations provided by the Design Professional of Record. Ducts shall be leak tested to one and one-half times the larger of the operating or design pressure. Measured leakage shall not exceed five percent of the design flow. Ducts shall be supported directly from fire-rated building structural elements.

7.7.6 **Equipment Inlets and Outlets:** (IBC 909.10.3) See 905.15.3 and 905.15.5 below.

7.7.7 **Automatic Dampers:** (IBC 909.10.4)
Dampers at smoke barriers shall be verified to be, at a minimum, a Class II leakage, 250^0 F smoke damper having a UL 555S listing. Report documentation shall include general listing number, with applicable manufacturer's data, and the device specific listing number (control number). The damper shall be verified to be within the dynamic listing requirements when applicable.

7.7.8 **Fans:** (IBC 909.10.5)
Fans and their associated motors shall be verified to approved engineering calculations for elevated temperature ratings where applicable. Fans operating at design conditions shall be verified to

manufacturer's data and standard engineering practices for stable performance. Belt driven fans shall be verified to have 1.5 times the number of belts required for the design duty with the minimum number of belts being two. Fans shall be verified for proper rotation when placed into a smoke-control mode. Smoke-control fans shall be shown on the firefighter's smoke control panel with a clear indication of airflow direction.

7.7.9 **Power Systems: (**IBC 909.11)
Primary power and secondary power systems shall be verified for all possible system permutations. Independent primary and secondary power distribution systems, including power conductors, shall be verified. Operation under standby power and its transfer time shall be verified. Existing smoke-control systems that are modified without additional (new) standby power loads are not required to demonstrate standby power operation and transfer time where documented in an approved fire protection report or test plan.

7.7.10 **Detection and Control Systems: (**IBC 909.12) Presence of power downstream of all disconnects shall be monitored. System activation shall be confirmed as described in the fire protection report for the specific project. Testing of passive system releasing devices shall include confirmation of listing for releasing service.

7.7.11 **Smoke-Control Diagrams:** (IBC 909.15)
Approved smoke-control diagrams shall be at the project site prior to rough mechanical inspection. Inspection shall include verification of device location and labeling in accordance with the smoke-control diagrams. One set of approved smoke-control diagrams shall be maintained at the Fire Command Center. Area detection shall be clearly shown or described on the drawings. Spot-type smoke detectors used for releasing service shall be designated on the drawings with sufficient detail to establish the location for each device required. Area detection may be used in lieu of spot-type smoke detectors when the listing allows for that use.

7.7.12 **Firefighter's Smoke Control Panel: (**IBC 909.16)
Verify that the firefighter's smoke control panel has priority over all possible control features of the smoke-control system for each possible permutation including standby power operation. Verify that each smoke zone and applicable equipment (fans, dampers, doors, etc.) is capable of manual operation from the firefighter's smoke control panel. Verify that the firefighter's smoke-control panel operates in accordance with the approved design. The firefighter's smoke control panel shall be located in the Fire Command Center.
Verify that each pressurized stair enclosure is monitored and controlled separately. Dampers and monitored doors (including doors for make-up air) require status indicators. All fans shall be indicated and controlled separately from dampers and doors on a zone-by-zone basis. Verify that variable frequency drive controllers (VFD's) operate in accordance with the approved test plan. VFD's shall comply with the Variable Frequency Drives used in Smoke-Control Systems policy dated June 24, 2002.

7.7.13 **Response Time: (**SNBCA 909.17)
Response times shall be verified to meet the requirements of this section. The start time for measuring the response time shall be when the initiating alarm is received at the fire fighter's control

panel. Each initiating device shall be tested. The operating status of output devices shall be indicated at the firefighter's smoke control panel within 60 seconds after an alarm is received at the Fire Alarm Control Panel.

7.7.14 **Acceptance Testing: (**IBC 909.18)
Verification testing shall be to an approved test plan. The test plan will document the method(s) to test the complete smoke-control system to demonstrate compliance with the applicable codes and Technical Guidelines. The test plan shall also cover passive zone testing (quantity and location) in addition to any other unique testing situations. Special conditions such as remodels to existing systems shall also be addressed.

7.7.15 **Detection Devices: (**IBC 909.18.1)
Smoke detection systems supervising mechanical smoke control systems shall comply with NFPA 72, the National Fire Alarm Code. Smoke detectors that are part of the smoke-control systems, including those used for area detection and for spot-type releasing service shall be tested in their installed condition. Testing shall include verification that the installed condition corresponds to the type of service outlined in the listing. Detectors that are used to control or release a device in a smoke barrier shall be tested. When applicable, the testing shall include verification of airflow in both the minimum and maximum conditions. See also IBC Section 715.3.

7.7.16 **Ducts, Inlets and Outlets: (**IBC 909.18.2 & 909.18.4)
Air quantities including capacities and velocities shall be reported in a manner that is consistent with generally accepted practices, such as AABC and NEBB.

7.7.17 **Dampers: (**IBC 909.18.3)
Damper testing and reporting shall include: listing number, individual listing reference number, type of damper (class), temperature rating, location per smoke-control diagrams, field label tag matching smoke-control diagram label, monitoring, report status for zone activation, standby power supply and response time.

7.7.18 **Fans:** (IBC 909.18.5)
Fans must be verified in accordance with IBC Section 909.18.5.

7.7.19 **Smoke Barriers:** (IBC 909.18.6)
Smoke Barriers must be verified in accordance with IBC Section 909.18.6.

7.7.20 **Controls: (**IBC 909.12, 909.18.7)
Mechanical smoke-control systems shall have completely automatic control. Every initiating device shall be tested and confirmed to place into operation each respective smoke zone pursuant to the approved documents. Testing documentation shall include confirmation of system activation and presence of power downstream of all disconnects. Fan and damper motor operation may be bypassed during testing of additional devices to preclude damage. Testing shall include all control sequences and that the firefighter's control panel has priority for all permutations. Control sequence testing may be conducted under simulation of standby power conditions. The method of simulation shall be addressed in the test plan. The control units of fire detection systems which supervise

mechanical smoke control systems shall comply with UL 864 and be listed as smoke-control equipment. A pre-programmed weekly test sequence report shall verify abnormal conditions audibly, visibly and by printed report.

7.7.21 **Special Inspections for Smoke Control:** (IBC 909.3, 909.18.8)
Scope of testing and agency qualifications must as a minimum comply with IBC Sections 909.18.8.1 and 909.18.8.2

7.7.22 **Reports: (**IBC 909.18.8.3 SNBCA)
Reports shall include manufacturer's data for all system initiation and output devices for both passive and active systems. Report review shall include signature and seal of QAA and responsible designer. For active systems this may be the mechanical engineer and for passive systems either the architect and/or author of the written submittal describing the smoke-control system (see 2000 SNBCA 909.18.8.3). A minimum of two smoke-control final reports shall be submitted a minimum of seven days prior to final inspection. Once accepted and stamped as approved a copy shall be provided by the QAA to the owner for retention in the Fire Command Center or other specifically approved location.

7.7.23 **Identification and Documentation: (**IBC 909.18.9)
The approved FPR, smoke-control diagrams, and Final Report constitute the documentation required by this section. This information shall be retained in the Fire Command Center or other specifically approved location. All systems devices shall have an identification label on them matching the identification as shown on the smoke-control diagrams.

7.7.24 **Acceptance: (**IBC 909.19)
An approved Final Report is required prior to building occupancy. A Final Report that is approved with exceptions may allow for temporary occupancy if the exceptions are documented and considered as not creating an unsafe condition or diminishing the safety of the building. Portions of a building may be granted temporary occupancy if the portion of the building to be occupied meets the above conditions and it is specifically documented in the partial Final Report by the QAA that the remaining portions of the building are not a hazard to the areas to be occupied. This partial Final Report may then be approved. Once the entire building is tested a complete Final Report may be required for the remaining portions with the prior accepted report(s) included within the complete Final Report.

7.8 Special Equipment:

Variable Frequency Drives that are intended to be used as part of the smoke-control system shall be identified on the smoke-control diagrams in terms of performance characteristics. The use of variable frequency drives is subject to approval. The variable frequency drive selected for use shall have supporting documentation submitted to either the Plan Examination or Inspection office in accordance with a letter to industry dated June 24, 2002. The variable frequency drive documentation will be attached to the approved smoke-control diagrams.

7.9 Smokeproof Enclosures: (IBC 909.20 SNBCA)

7.9.1 Access (IBC 909.20.1)
Access construction must be verified by CCDDS-BD personnel.

7.9.2 Construction (IBC 909.20.2)
Rated construction must be verified by CCDDS-BD personnel. Automatic closing doors must be verified to confirm installation in accordance with the listing and operation as required by IBC Section 909.20.2.

7.9.3 Natural Ventilation Alternative (IBC 909.20.3)
Natural ventilation construction must be verified by CCDDS-BD personnel.

7.9.4 Mechanical Ventilation Alternative (IBC 909.20.4)
IBC amended to delete Sections 909.20.4 through 909.20.4.4

7.9.5 Stair Pressurization Alternative (IBC 909.20.5)
IBC amended and includes four new subsections. The new sections pertain to Pressure Difference, Vestibule Doors, Dampered Relief Opening and Location of Standpipe Connections.

7.9.6 Ventilating Equipment (IBC 909.20.6)
Ventilating equipment must be verified to operate under both normal power and stand by power.

7.10 Underground Building Exhaust System: (SNBCA 909.21)
IBC section has been amended and sections 909.21.1 through 909.21.3 are deleted.

8.0 RECORDS: The following documents are official records and maintained as such by the CCDDS Records Office. An identical copy of these documents shall be maintained at the Fire Command Center or other approved location.

Fire Protection Report
Smoke-Control Diagrams
Smoke-Control Final Report
Smoke-Control Test Plan
Fire Alarm Drawings

9.0 ATTACHMENTS:

Annex 1 – Supplemental Information
General Responsibilities – Attachment A
Smoke-Control Diagram Checklist -Attachment B
Smoke-Control Test Plan Checklist – Attachment C
Example Drawing Standards – Attachment D
Final Report Checklist – Attachment E

10.0 REVISION HISTORY:

Title	Revision/Approved Date	Effective Date
TG-60-97	January 20, 1997	January 20, 1997
TG-60-2003/UBC	January 7, 2004	February 1, 2004
TG-60-IBC-2000	September 15, 2004	October 1, 2004

Annex 1 – Supplemental Information

Complex Facilities Guide – November 2001
Clark County Department of Development Services

Fire Protection Report Design Guide – September 2003
Clark County Department of Development Services

Guide to the 1997 UBC SMOKE-CONTROL PROVISIONS
Douglas H. Evans, P.E. copyright 1999
ISBN 1-58001-023-7

Smoke Control Provisions of the 2000 IBC: An Interpretation and Applications Guide
Douglas H. Evans, P.E. and Dr. John H. Klote, P.E. copyright 2003
ISBN 1-58001-107-1

Procedure for Applications Involving Alternate Materials and Methods of Construction – May 2001
Clark County Department of Development Services

Uniform Guideline for Smoke Control Testing and Recertification
Southern Nevada Fire Chief's Association – Fire Code Committee June 19, 2003

Attachment - A
General Responsibilities – Non-mandatory
Page 1 of 2

Code Section	Subject	Prime Agency Inspection	Air Balance Inspection	Prime Agency Testing	Air Balance Testing	Building Division
909.5	Smoke Barrier Construction			X	X	
909.5.2 SNBCA	Opening Protection			X		X
909.4.6	Duration of Operation			X	X	
909.6	Pressurization Method					X
909.6.1	Minimum Pressure Difference				X	
909.6.2	Maximum Pressure Difference			X		
909.7	Airflow Method					X
909.7.1	Velocity (minimum average)	X			X	
909.7.2	Prohibited Conditions	X			X	
909.8	Exhaust Method					X
	General	X			X	
909.9	Design Fire					X
909.10	Equipment			X		
909.10.1	Exhaust Fans	X				X
909.10.2	Ducts	X			X	
909.10.3	Equipment / Inlets & Outlets	X				
909.10.4	Automatic Dampers	X			X	
909.10.5	Fans	X	X		X	
909.11	Power Systems	X		X		X

Code Section	Subject	Prime Agency Inspection	Air Balance Inspection	Prime Agency Testing	Air Balance Testing	Building Division
909.12	Detection and Control Systems	X		X	X	
909.13	Control Air Tubing		X		X	
909.14	Marking and Identification	X	X			
909.15	Control Diagrams	X				X
909.16	Fire-fighter's Smoke Control Panel	X				
909.17 SNBCA	System Response Time	X		X		
909.18 909.3	Acceptance Testing	X		X		
909.18.1	Detection Devices			X	X	
909.18.2	Ducts				X	
909.18.3	Dampers			X	X	
909.18.4	Inlets and Outlets				X	
909.18.5	Fans	X			X	
909.18.6	Smoke Barriers	X			X	
909.18.7	Controls			X		
909.18.8.3 SNBCA	Reports	X				
909.18.9	Identification & Documentation	X	X			
909.19	System Acceptance					X

Smoke-Control Diagram Checklist - Attachment B
Page 1 of 3

☐ Current revision number and revision date

☐ PE stamp – Nevada

☐ Scope

- Coordinate with fire protection report
- Reference adjacent zones in existing construction

☐ Legend

☐ Locate fire command center

☐ Locate emergency generator

☐ Zone Boundaries

- Locate and identify smoke zone boundaries on floor plans and section
  - Active and passive zones
  - Active and passive subzones
  - Pressurized stair enclosures including vestibules
  - Elevator hoistways and lobbies
  - Corridors, exit passageways and horizontal exits
  - Linen and trash chutes
  - Fire walls
  - Atria
  - Mall / tenant interface
- Locate and identify sprinkler zone boundaries (sprinkler initiated systems)
- Specify design method on a zone-by-zone basis
- Smoke compartment boundaries in E and I occupancies

Smoke-Control Diagram Checklist - Attachment B
Page 2 of 3

☐ Major Components

- Locate and identify initiating devices
  - Water flow switches
  - Beam, flame and heat detectors
  - Spot-type smoke detectors (See 7.7 – Smoke-control diagrams)
  - Extent of area detection (See 7.7 – Smoke-control diagrams)
- Locate and identify output devices
  - Stair and elevator machine room pressurization fans
  - Exhaust fans required for smoke-control
  - Air handling units which supply or recirculate > 2,000 cfm
  - Dampers at smoke zone boundaries
  - Held-open doors at zone boundaries
  - Proscenium curtains
  - Large rolldown, drop or accordion doors at zone boundaries
  - Pressurized stair barometric relief dampers
- Same identifying tags shown on location drawings and in matrix

☐ Operation

- Matrix or flow chart
  - matrix preferred
    - Rows are initiating devices
    - Columns are functional responses
- Include all device tags
- Coordinate with matrix from fire protection report
  - Include loss of primary power

☐ Ducts

- Locate smoke-control ducts crossing zone boundaries

Smoke-Control Diagram Checklist - Attachment B
Page 3 of 3

☐ Control wiring details

- Interconnection of input and output devices with the smoke-control panel
- Connection of variable frequency drives and other intermediate fan controllers
- How manual override is achieved
- Show electrical control equipment
  - Current sensors
  - Motor starters
  - Relays
  - End switches
  - Pilot lamps or LED's
  - Interlocks
  - Emergency power
- Duct detector closure of smoke dampers and shutoff of supply fans for any system supplying or recirculating > 2,000 cfm
- Status indicators
  - Proscenium curtains
  - Large rolldown, drop or accordion doors at zone boundaries

☐ Equipment specifications

- Temperature rating
- Dedicated vs. non-dedicated
- Motor service factor 1.15
- Fan minimum flow capacities
- Minimum number of belts
- Labels with required information

Attachment - C

Smoke-Control Test Plan Checklist (IBC 909.3)

2000 International Building Code

A smoke-control test plan summary checklist shall be completed for every portion of a building on a smoke zone basis. These summary checklists shall be submitted as part of the fire protection report. The test plan shall be based on the items identified below and the details of the test plan shall be submitted with the smoke-control diagrams. Identify below the verification required for a given smoke-control zone.

Project _____ Permit Number _____

Smoke-Control Zone (Activation Zone) _____

Design Methods 909.6, 909.7, 909.8

☐ Pressurization Method ☐ Airflow Method ☐ Exhaust Method

☐ Smoke Barrier Construction 909.5

☐ Opening Protection 909.5.2 (SNBCA)

Equipment 909.10

☐ Exhaust Fans ☐ Ducts ☐ Equipment, inlets and outlets

☐ Automatic dampers ☐ Fans

☐ Power Systems 909.11 ☐ Detection and control systems 909.12

☐ Marking and Identification 909.14 ☐ Control diagrams 909.15

☐ Smoke control panel 909.16.2 (SNBCA) ☐ System Response Time 909.17 (SNBCA)

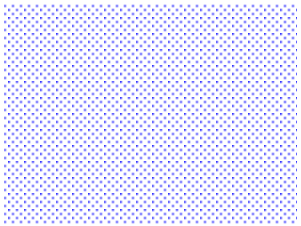
Acceptance Testing 909.18

☐ Detection devices ☐ Ducts ☐ Dampers

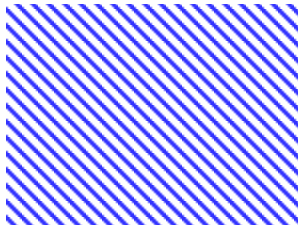
☐ Inlets and outlets ☐ Fans ☐ Smoke Barriers

☐ Controls ☐ Reports

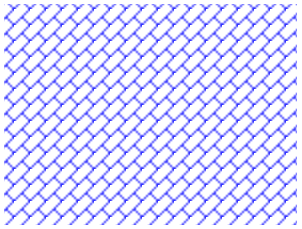
Attachment – D {Example Only}



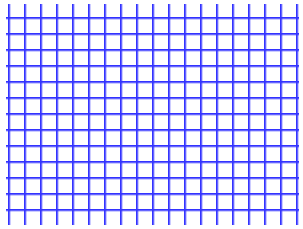
Activation Zone 1



Activation Zone 2



Activation Zone 3



Activation Zone 4

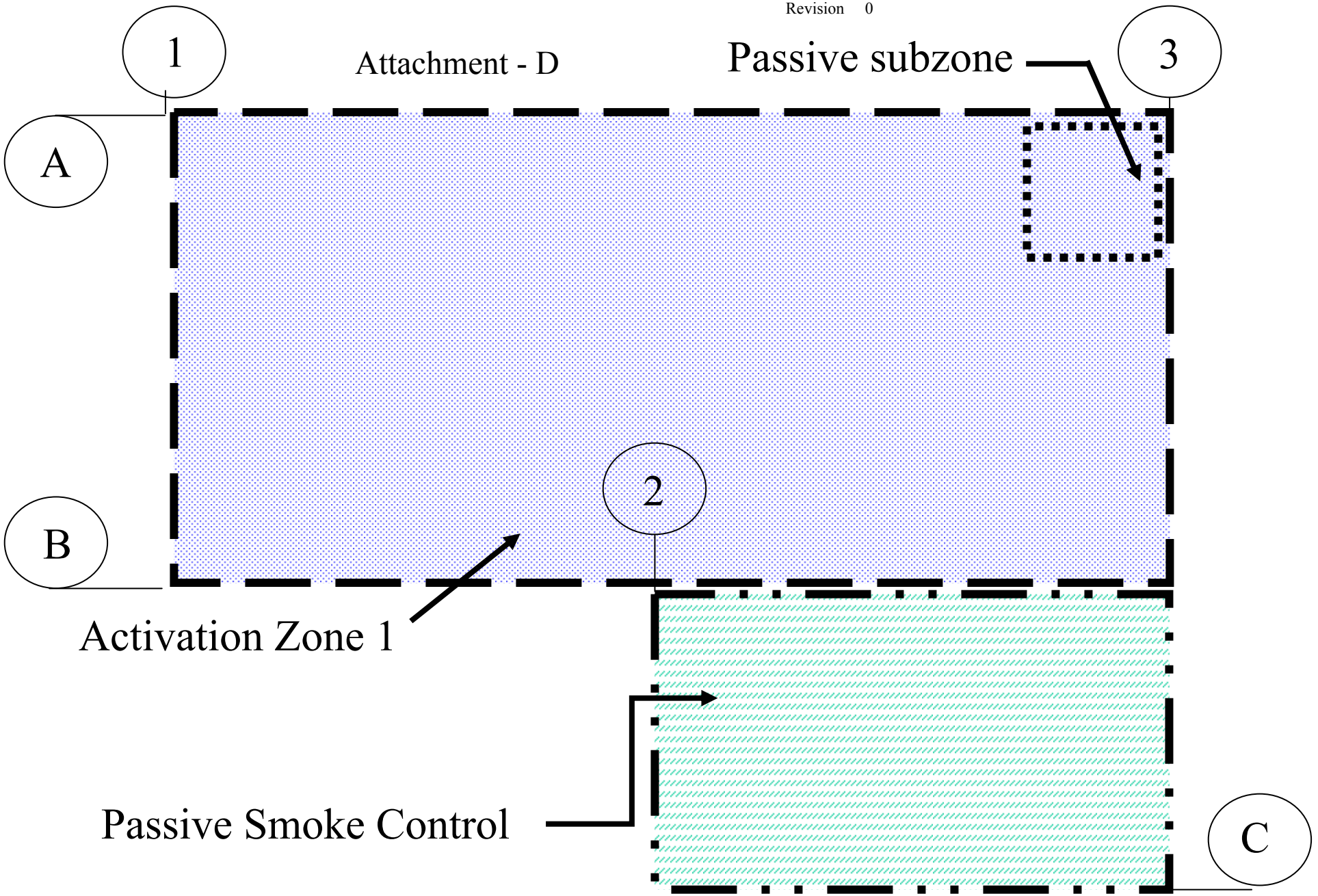
Mechanical Smoke Zone Boundary

Passive Smoke Zone Boundary

Passive Subzone Zone Boundary

Smoke Compartment Boundary

Attachment - D



Final Report Checklist – Attachment E
Code references to 2000 IBC
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☐ Typical Final Report Requirements	Section 7.0, TG 50
☐ Stamps o Mechanical Engineer of Record o Air Balance Agency o Mechanical Engineer of Record compliance statement	Section 909.18.8.3 SNBCA
☐ Scope o Final – full description o Partial Final – description	Section 7.19, TG 50
☐ Passive Zones o Room leakage calculations o Door fan test sheets	Sections 909.5, 909.6.1
☐ Differential Pressures o Test sheets	Sections 909.5, 909.6.1, 909.18.6
☐ Stairs o Test sheets showing • Barometric relief damper operation at 0.05”H_20 • Barometric relief damper flow ≥ 2,500 cfm • 0.05 ”H_20 minimum pressure differential from vestibule to stair and from vestibule to floor area	Sections 1005.3.3.7 909.18.6
☐ Door Opening Forces 5#, 15#, 30# ☐ Maximum opening and door swing forces o Test and report applicable conditions	Sections 909.6.2 1003.3.1.2
☐ Duct Leakage o Test sheets showing 1.5 x the larger of the operating or design pressure with < 5 % leakage	Section 909.10.2
☐ Detectors o Test sheets showing smoke-control initiation for all initiating devices o Equipment data sheets	Sections 715.2, 715.3.2, 909.12.2, 909.18.1

Final Report Checklist – Attachment E
Code references to 2000 IBC
Page 2 of 2

☐ Smoke-Control Diagrams o Reference latest revision of approved drawings	Section 905.12
☐ Smoke Control Initiating Devices o Activation per drawing matrix and fire protection report o Smoke zone boundaries correspond with sprinkler zone boundaries o Response times	Sections 715.3.2, 909.12.2, 909.12.3, 909.16, 909.17 SNBCA, 909.18
☐ Fans o Test sheets showing • Flow operating conditions per design • Fan belt items • Fan motor items • VFD items • Response time • Temperature ratings • Presence of power downstream of disconnects	Sections 909.10.5, 909.17 SNBCA, 909.18.4, 909.18.5 VFD letter to industry
☐ Equipment Data Sheets o Fans o Dampers o Doors o Other major smoke-control equipment o Traceability by tag numbers per drawings ☐ Emergency Power Test	Sections 703.4, 715.3, 909.18.8.3, 909.18.9 Section 909.11
☐ Daily Reports	Section 7.5.2, TG 16
☐ Non-Compliances	Sections 6.5.2.2, 7.5.3.3, 7.5.3.4, TG 16
☐ Life-Safety System Test Scenarios	